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Study of thyroid dysfunction in patients of type 2 diabetes mellitus

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Abstract

Background: Type 2 Diabetes mellitus (T2DM) and thyroid dysfunction are most common metabolic disorder with its increasing incidence worldwide. Untreated thyroid disorder can adversely affect glucose and lipid metabolism and predisposes patient to atherosclerotic diseases like coronary artery disease and stroke.

Aims and objective: To study thyroid function in T2DM and correlate it with age, sex, body mass index, lipid profile, glycemic control, duration and complications of diabetes.

Materials and Methods: Eighty two T2DM patients were studied prospectively for thyroid function in the Department of Medicine of JA group of Hospitals, GR Medical College, Gwalior from September 2011 to October 2012. A detailed medical history (age, sex, duration of diabetes and existence of symptoms), physical/clinical examination (SBP, DBP, BMI and waist hip ratio), laboratory investigations (complete blood count, blood sugar, blood urea and serum creatinine, liver function test, USG abdomen, urine R/M, serum lipid profile, ECG and chest X-Ray was performed in all patients.

Results: Thyroid dysfunction was found in 21.9% of the T2DM subjects and 7.3% in control. Fatigability (29%) followed by dryness of skin (18.29%) were the most common symptoms of thyroid dysfunction. Mean FT3, FT4 and TSH in cases and control was 2.04 ± 0.92 and 2.46 ± 0.83 ($p=0.015$), 1.29 ± 1.47 and 1.45 ± 0.39 ($p=0.495$), 5.14 ± 5.68 and 4.20 ± 1.91 ($p=0.305$). In study cohort, 78.1% patients had euthyroidism, 20.7% had hypothyroidism and 1.25 had hyperthyroidism. Patients with HbA1c between 7.6-8.5%, 60% were euthyroid and 40% were hypothyroid and with HbA1c between 8.6-9.5%, 90% were euthyroid and 10% were hypothyroid whereas patients with diabetes duration between 5-10 years, 67.8% were euthyroid and 32.14% were hypothyroid and with diabetes duration >10 years, 75% were euthyroid and 25% were hypothyroid.

Conclusion: Thyroid dysfunction mainly hypothyroidism is more prevalent in T2DM compared to healthy subjects, routine testing is recommended in all diabetes patients.

Keywords: Thyroid dysfunction, T2DM, hypothyroidism, HbA1c, fatigability

Introduction

Type 2 diabetes mellitus (T2DM) and thyroid dysfunction are commonly encountered endocrine disorders [1]. In 1979 first report explaining the association between both the disorders was published since then many researchers have worked over it [2].

Depending on the environmental and host factor thyroid disorder varies in different population. Prevalence of thyroid disorder range from 6.6% to 13.4% [3, 4]. Its prevalence further increases in T2DM population which range from 10-24% [5, 6]. Presence of thyroid dysfunction affects the diabetes control.

There are various implications for patients with both T2DM and thyroid dysfunction. In hyperthyroid patients, the diagnosis of glucose intolerance needs to be considered cautiously, since the hyperglycemia may improve with treatment of thyrotoxicosis.

The relationship between thyroid dysfunction and T2DM is characterized by a complex interaction of interdependence. Screening of thyroid dysfunction, especially the subclinical disorder, in patients with T2DM is justified because most patients can be asymptomatic. Hence present study was performed to study thyroid dysfunction in patients with T2DM.

Materials and Methods

A prospective study was performed in randomly selected 82 T2DM patients without having past history of thyroid dysfunction in the Department of Medicine of JA group of Hospitals, GR Medical College, Gwalior from September 2011 to October 2012.

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T2DM with age more than 30 years without having history of thyroid dysfunction were included and patients with conditions that may alter thyroid function such as pregnancy, autoimmune disease, patients who had received radiation therapy to neck, patients taking antithyroid medication and seriously ill patients were excluded from the present study.

A written informed consent from each patients and Institutional Ethics Committee approval was obtained before starting the study.

A details medical history including age, sex, duration of diabetes and existence of symptoms such as numbness, hyperaesthesia and any visual problem and history of any diabetic medication was recorded in pre-approved format, physical examination and investigations including complete blood count, blood sugar test (fasting blood sugar; FBS, postprandial blood sugar; PPG, glycated hemoglobin; HbA1c), blood urea and serum creatinine, liver function test, USG abdomen, urine R/M, serum lipid profile, ECG and chest X-Ray were done all the patients. Patients were also investigated for thyroid function using chemiluminescence method. Age and sex matched 41 healthy subjects were also randomly selected and undergone thyroid function test including FT3, FT4 and TSH.

Diagnosis of diabetes mellitus was based on ADA-WHO diagnostic criterion (FPG \geq 126 mg/dl, PPG using OGTT test \geq 200 mg/dl, RBS \geq 200 mg/dl with one or diabetes symptoms and HbA1c \geq 6.5%)

Patients satisfying the inclusion criteria was then evaluated for symptoms and sign of thyroid dysfunction such as thyroid swelling, fatigability, menstrual irregularities, cold/heat intolerance, constipation/ loose motions, impairment of memory, insomnia, depression, muscle cramps, joint pain, dryness of skin, bradycardia/tachycardia. The patients were then subjected to thyroid function test; FT3, FT4, TSH, USG neck and FNAC (as and when required).

All the data was analyzed using IBM SPSS version 20 software. Data are expressed as percentage and numbers and mean \pm SD. Data was analyzed using frequency distribution, cross tabulation and chi-square test. Level of significance was assessed at 5% level.

Results

Mean age of study cohort in Cases and Control group was 52.57 \pm 11.41 and 51.60 \pm 11.23 years respectively (p=0.665).

More than 50% of the patients were above 50 years of age (57.3%). Male preponderance was recorded in Cases (60.97%) and Control (53.65%) groups (p>0.05).

Mean SBP, DBP, BMI and waist hip ratio in Cases and Control was 130.24 \pm 26.57 and 132.09 \pm 8.19 mmHg (p=0.971), 79.26 \pm 14.80 and 80.43 \pm 6.54 mmHg (p=0.630), 26.10 \pm 3.47 and 23.82 \pm 2.69 kg/m² (p=0.003), 0.99 \pm 0.26 and 0.82 \pm 0.16 (p=0.002) respectively.

HbA1c (8.87 \pm 2.45 vs. 4.94 \pm 0.57; p<0.001), FBS (156.41 \pm 53.06 vs. 92.97 \pm 9.60; p=0.001) and PPBS (219.52 \pm 72.53 vs. 122.24 \pm 10.14; p=0.001) were significantly higher in Study group compared to Control group respectively.

About 33% of the T2DM patients had HbA1c more than 9.5% showing poor control of diabetes. Approximately 22% of the cohort had newly detected T2DM and 39% had diabetes for less than 5 years. Thus the population of the present study was relatively young in age with recent onset diabetes.

Most common symptoms in T2DM patients was polyuria (51%) followed by weakness (43%), polydipsia (37%) and breathlessness (37%). As expected coronary artery disease (25.6%) led the group with more than one quarter of the diabetic patients having it. Retinopathy followed with 18.3%. Neuropathy was seen in 14.63% and nephropathy in 10.97% patients.

About 37% of the T2DM patients were on oral hypoglycemia agents. One third of the patients were not taking any treatment. Of these 29 patients, 18 were newly diagnosed and rest showed poor compliance. Antihypertensives were the most common drugs consumed besides anti diabetics drugs and 11% were on anti ischemic drugs.

Mean TC, TG, HDL, LDL and VLDL in Cases and Control was 185.51 \pm 59.56 and 181.69 \pm 37.71, 159.67 \pm 66.42 and 117.43 \pm 40.88. In Cases and Control, 15 (18.3%) and 7 (17.7%) were smokers whereas 13 (15.9%) and 4 (9.76%) were alcoholic respectively. Most common symptoms related to thyroid dysfunction was fatigability (29%) followed by dryness of skin (18.29%) and bowel disturbance (18.29%).

Mean FT3, FT4 and TSH in cases and control was 2.04 \pm 0.92 and 2.46 \pm 0.83 (p=0.015), 1.29 \pm 1.47 and 1.45 \pm 0.39 (p=0.495), 5.14 \pm 5.68 and 4.20 \pm 1.91 (p=0.305). In present study, 64 (78.1%) patients had euthyroidism, 17 (20.7%) had hypothyroidism and 1 (1.25) had hyperthyroidism.

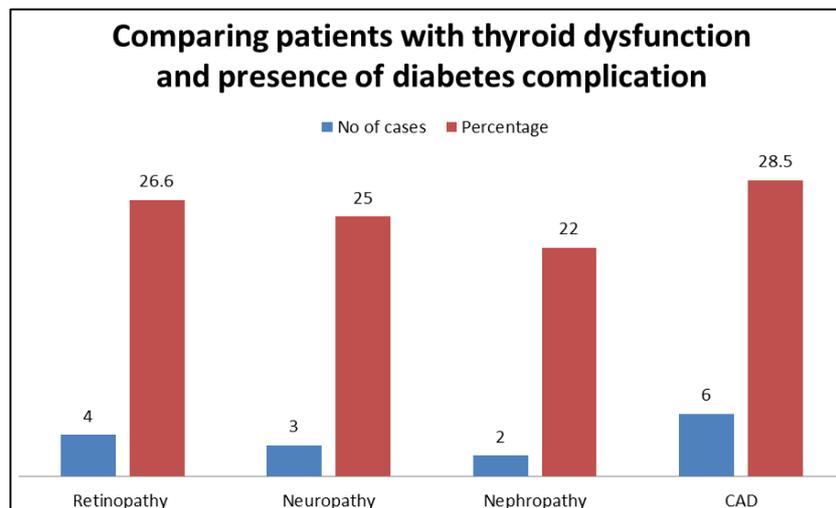


Table 1: Comparing diabetes parameters with thyroid dysfunction

Diabetes parameter		Euthyroid	Hypothyroid	Hyperthyroid
HbA1c (%)	≤6.5	9 (81.8)	2 (18.2)	0 (0)
	6.6-7.5	14 (73.7)	4 (21.1)	1 (5.2)
	7.6-8.5	9 (60)	6 (40)	0 (0)
	8.6-9.5	9 (90)	1 (10)	0 (0)
	>9.5	23 (85.2)	4 (14.8)	0 (0)
Diabetes duration (years)	<5 (n=50)	42 (84)	8 (16)	0 (0)
	5-10 (n=28)	19 (67.8)	8 (32.14)	1 (3.5)
	>10 (n=5)	3 (75)	1 (25)	0 (0)

Data is expressed as no of patients (percentage), HbA1c; glycated hemoglobin

Discussion

T2DM seems to affect thyroid function at two sites, first by controlling TSH release from hypothalamus and second by controlling conversion of T4 to T3 at peripheral tissue. Hyperglycemia causes reduction in hepatic concentration of T4-5 deiodinase, low serum concentration of T3, raised levels of reverse T3 and low, normal, or high level of T4. Metabolism is regulated by metabolism whereas T2DM can alter the metabolism [7].

Similar to present study, Uppal *et al* studied 117 T2DM patients and reported that fasting blood glucose and glycosylated haemoglobin levels were significantly higher in diabetics showing a poor glucose control [8].

In present study thyroid dysfunction was more prevalent in T2DM patients compared to healthy subjects. Our observations are consistent with previous similar studies performed by Ghazali S M *et al* [9], Gurjeetsingh *et al* [10], Radaideh AR *et al* [11], Laloo Demitrost *et al* [12], Perros *et al.* [13] and Athanasia Papazafiropoulou *et al.* [14] reported 29.7%, 30%, 12.5%, 31.2%, 32.4%, 13.4% and 12.3% respectively.

Vikhe *et al* studied 50 diabetic and 50 non diabetic patients for thyroid dysfunction and reported 30% subject showing abnormal thyroid hormone levels. Most of them showed hypothyroidism (22%) and 8% had hyperthyroidism, which is in agreement with the present study where thyroid dysfunction was found in 21.9% of the T2DM subjects, most common was hypothyroidism (20.7%) and 1.25% had hyperthyroidism [15].

Palma *et al* studied 386 subjects with T1DM and T2DM and reported that prevalence of thyroid dysfunction was 14.7% and most frequent thyroid dysfunction was subclinical hypothyroidism (13% of patients with T1DM and in 12% of patients with T2DM) [16]. Similar reports were depicted in the present study.

In a study by Moghetti *et al.* [17], 89% of patients had hypothyroidism and 11% had hyperthyroidism. Celani *et al.* [18] showed maximum prevalence of subclinical hypothyroidism followed by hypothyroidism (23.1%). Hypothyroidism was shown to be more prevalent thyroid disorder in T2DM in the studies of Udiong *et al.* [19]

In present study, FT3 was significantly lower in Cases compared to Control but Mawar *et al* reported that level of T3 and T4 did not change significantly in diabetic subjects as compared to the control subjects. The serum TSH level was significantly higher in diabetic patients as compared to healthy control subjects [20].

Whereas in agreement with present study Uppal *et al* reported that serum tri-iodothyronine values were significantly lower in diabetics. There was a significant correlation between glycosylated haemoglobin and thyroid hormones [8].

Present study had few limitations of being cross sectional in nature; hence the results cannot be applied to whole populations and also small sample size taken in present study demand a large randomized clinical trial to strengthen the results.

Conclusion

In present study, diabetic subjects were found to be more prone to have thyroid dysfunction than the healthy subjects, most common being hypothyroidism. Of the thyroid function test T3 was the most significant in terms of difference of means between Study and Control. The duration of diabetes, age of subjects, level of control of diabetes estimated by HbA1c, presence or absence of comorbid conditions or complications and the level of blood sugar had no correlation with the presence or absence of thyroid dysfunction.

To conclude, there were enough hypothyroid cases (both asymptomatic and symptomatic) even through the sample size was small, to warrant a conclusion that routine testing of thyroid function in all diabetics will be beneficial and should be recommended.

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